STABLE LAWS AND THE NUMBER OF ORDINARY

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Power total number of primes from the discharge of the decimal system is identified by the law of exponential growth with 14 fundamental physical constants. Model obtained on the parameters of the physical constants, proved less of the error and it gives more accurate predictions of the relative power of the set of prime numbers. The maximum absolute error of power (the number of primes), the traditional number is three times higher than suggested by us complete a number of prime numbers. Therefore, the traditional number 2, 3, 5, 7, ... is only a special case. The transformation ln = 2,302585 ... it was a rough rounded, leading to false identification of physico-mathematical regularities of different series of prime numbers. Model derived from physical constants, proved more accurate than the relative accuracy, and it gives more accurate predictions of the relative power of the set of prime numbers with increasing discharge the decimal number system.

Keywords: primes, total number, physical constants, the relationship

Prime number – is a natural number $N = \{0, 1, 2, 3, 4, 5, 6, ...\}$ that has two positive divisors: one and itself.

There are several variants of distribution or **a series of prime numbers (SPN):**

1) finite number of critical primes $P = \{0, 1, 2\}$;

2) non-critical prime numbers $P = \{3, 5, 7, 11, 13, 17, ...\}$;

3) the traditional [1] number of primes $a(n) = \{2, 3, 5, 7, 11, 13, 17, ...\}$ with order (serial number) $n = \{1, 2, 3\}$, which was considered by many scientists and by Riemann;

4) part series of prime numbers [2] $P = \{1, 2, 3, 5, 7, 11, 13, 17, ...\}$;

5) the total number of prime numbers $P = \{0, 1, 2, 3, 5, 7, 11, 13, 17, ...\}$ that are equivalent row N.

The literature focuses on SPN_3, and we did not find sufficient publications on the analysis of SPN_4 and other ranks have been proposed by us. In this reader a series of five articles examined SPN_1, SPN_2 SPN_5 and compared with evidence SPN_3.

In the analysis of stable laws have been applied [3] to the distribution of prime numbers.

Biotechnical law and its fragments. Under the scheme «from the simple to the complex structure» in table 1 are all stable laws are used to construct formulas biotech laws. Generalizing formula is biotech law [3]. Most often, the sum of two biotech laws constitutes a deterministic allocation model. Formula, together with a finite set SPN runs in a software environment CurveExpert for parameter identification of a stable law and wave patterns.

Table 1

Mathematical constructs in the form of stable laws to build a statistical model

Fragments without previous history of the phenomenon or process	Fragments from the prehistory of the phenomenon or process
$y = ax$ – law of linear growth or decline (with a negative sign in front of the right side of this formula)	$y = a$ – the law does not impact adopted by the variable on the indicator, which has a prehistory of up period (interval) measurements
$y = ax^b$ – **exponential growth law** (law of exponential death) $y = ax^{-b}$ is not stable because of the appearance of infinity at zero explanatory variable	$y = a\exp(\pm cx)$ – law of Laplace in mathematics (Zipf in biology, Pareto in economics, Mandelbrot in physics) exponential growth or loss respect to which the Laplace created a method of operator calculus
$y = ax^b\exp(-cx)$ – biotech law (law of life skills) in a simplified form	$y = a\exp(\pm cx^d)$ – **law of exponential growth or death** (P.M. Mazurkin)
$y = ax^b\exp(-cx^d)$ – **biotech law**, proposed by professor P.M. Mazurkin	

For the processes of behavior of living and/or inert substances (according to V.I. Vernadsky) parameters a, b, c, d biotech law and its fragments may approach to the fundamental physical constants, and it has been shown in the distribution of chemical elements [4].

Power series of prime numbers. According to [1] SPN_3 and our calculations on SPN_5 in table 2 shows the cardinal numbers and their relationships SPN_5/SPN_3.

In the first digit decimal numbers the difference between a full and traditional rows of simple number is equal to 150 %. The relative cardinal number is the maximum 100,31 at $i_{10} = 6$ and minimum 66,67 at $i_{10} = 1$. What SPN better? In advance, we say that SPN_5.

Table 2

The relative cardinal number the increase in the capacity (quantity) of prime numbers

Discharge i_{10}	The power of numbers x	Traditional SPN_3 [1]		Full SPN_5		SPN_5/ SPN_3, %	
		Power $\pi(x)$	$x/\pi(x)$	Power $\pi(x)$	$x/\pi(x)$	$\pi(x)$	$x/\pi(x)$
1	10	4	2,5	6	1,6667	**150,00**	66,67
2	100	25	4,0	27	3,7037	108,00	92,59
3	1 000	168	6,0	170	5,8824	101,19	98.04
4	10 000	1 229	8,1	1 231	8.1235	100,16	100,29
5	100 000	9 592	10,4	9 594	10,4232	100,02	100,22
6	1 000 000	78 498	12,7	78 500	12,7389	100,00	**100,31**
7	10 000 000	664 579	15,0	664 581	15,0471	100,00	100,31
8	100 000 000	5 761 455	17,4	5 761 457	17,3567	100,00	99,75
9	1 000 000 000	50 847 534	19,7	50 847 536	19,6666	100,00	99,83
10	10 000 000 000	455 052 512	22,0	455 052 514	21,9755	100,00	99,89

Traditional SPN. With the increase in decimal place of natural numbers the increase in the relative cardinal number of the set of prime numbers with a capacity of more than 455 million occurs (fig. 1) by a deterministic model of the law of exponential growth.

$$x / \pi(x) = 0,00066575 \exp\,(8,10285\, i_{10}^{0,10893}). \qquad (1)$$

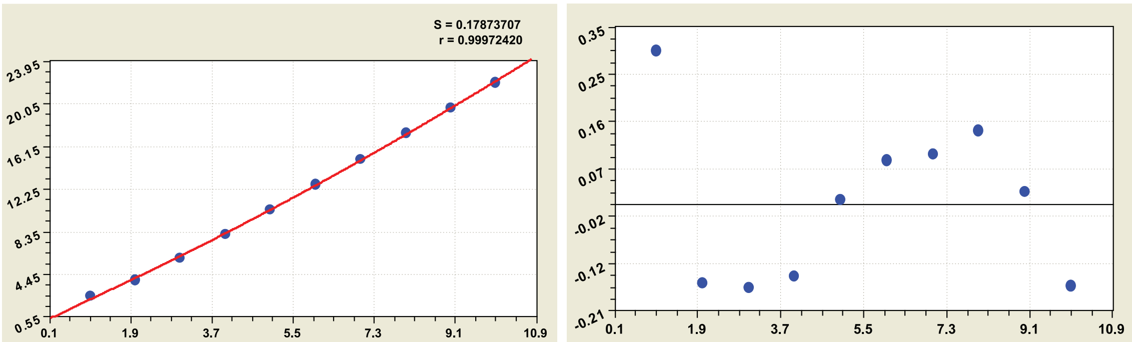

Fig. 1. The schedule of the law of exponential growth (1) the relative power and remains after it: S – Dispersion; r – correlation coefficient

On the balances was obtained of the wavelet function (described in the second article)

$$\varepsilon = 88,26937 \exp\,(-5,36239\, i_{10}^{0,098706}) \cos\left(\frac{\pi i_{10}}{0,59537 + 1,47125\; i_{10}^{0,27860}} - 0,67755\right). \qquad (2)$$

The law of exponential death before the cosine function shows half of the amplitude of the oscillatory perturbations of power SPN_3. Because of the high value of the remainder for $i_{10} = 1$, we have that zero discharge is theoretically possible number of prime numbers must be 88. Combining formulas (1) and (2) gives the binomial model with the wave function of the form

$$x / \pi(x) = 0,00074272 \exp\,(8,15289\, i_{10}^{0,10111}) +$$

$$+956,514 \exp\,(-5,28998\, i_{10}^{0,21896}) \cos\left(\frac{\pi i_{10}}{-0,14154 + 15,52749\; i_{10}^{-0,33681}} + 1,38397\right). \qquad (3)$$

Top of the wave has moved up to 957 prime numbers with zero discharge of the decimal system. In addition, under the function of the cosine of half-cycle fluctuations has changed: the beginning shifted to the first digit of the negative numbers. Half-life increases sharply, and the intensity parameter of death −0,33681 shows anomalous behavior of the model (3).

Full range. This SPN_5 received a deterministic pattern (fig. 2) the type of

$$x / \pi(x) = 1,50030 \cdot 10^{-24} \exp\,(55,46724\; i_{10}^{0,019036}). \qquad (4)$$

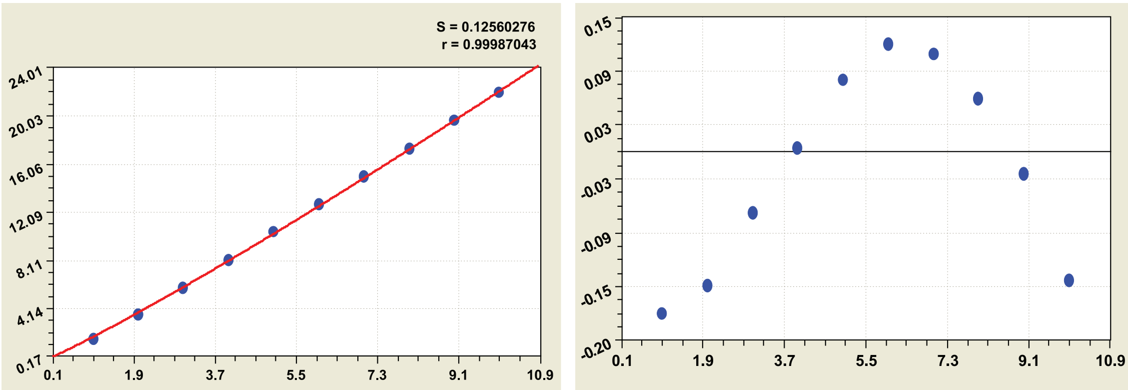

Fig. 2. Schedule of the law of exponential growth (4) and residues from himt

Residues have a relatively smooth swing and determined by the formula:

$$\varepsilon = -0,20751 \exp\,(-0,16759\, i_{10}^{0,48624}) \cos\left(\frac{\pi i_{10}}{8,19322 - 0,31718\; i_{10}^{0,99304}} - 0,22080 \right). \qquad (5)$$

In formula (5), half of the amplitude of the perturbations of the power SPN_5 has the numerical value of all 0,20751. The initial half-life 8,19322 damped oscillations approaching 8.

The general equation is characterized by binomial formula

$$x / \pi(x) = 1,49766 \cdot 10^{-24} \exp\,(55,46556\, i_{10}^{0,019025}) -$$

$$-0,18905 \exp\,(-0,0032736\; i_{10}^{1,00713}) \cos\left(\frac{\pi i_{10}}{7,40869 - 0,23358\; i_{10}^{0,61848}} - 0,028862 \right). \qquad (6)$$

Do not change the scale of reference of natural primes. This recommendation for the future in the study of prime numbers comes from the fact that, from Riemann used the natural logarithm and are looking for an empirical formula [1]. To quote from an article by Don Zagier: «Apparently (see table 2), that the ratio of x to $\pi(x)$ the transition from a given degree of ten to follow all the time increases to about 2,3. Mathematics is recognizable among the 2,3 log 10 (of course, to base e). The result suggested that the $\pi(x) \sim |x / \ln x|$, where the sign ~ means that the ratio of their expressions are connected with x tends to 1. This asymptotic equation, first proved in 1896, is now the law of **distribution of prime numbers**. Gauss, the greatest of mathematicians, discovered this law in the age of fifteen, studying tables of primes contained in the gift to him a year before the table of logarithms».

We were not too lazy to check the statement «the ratio of x to $\pi(x)$ in the transition from the present level of ten to follow all the time increases by about 2,3» and the results of the calculations resulted in table 3. Here, the number 2,30 in SPN_3 not (if there is, the approximation error to 2,30 at $100(2,5 - 2,3)/2,3 = 8,70\,\%$, which is very much), but there is an aspiration to 1. At the same time the full range of gives at the beginning of the interval of digits in a larger multiplicity 2,22 (error of 3,47 %).

Equal to the power of two sets SPN_3 and SPN_5 can be considered, starting with the digits $i_{10} \geq 9$ in decimal notation.

With the growth of x a true statement is the convergence to 1. For this purpose we identify the law of death (in a general form of table 1) according to the statistical data of table 3.

For the full range of the obtained formula

$$card\left(\frac{x_i}{\pi(x_i)} \Big/ \frac{x_{i-1}}{\pi(x_{i-1})} \right) = 1,09980 + 1788,3968 \exp(-6,20754 i_{10}^{\;0,24956}). \qquad (7)$$

Table 3

The multiplicity of cardinal number

Discharge i_{10}	Private SPN_3 [1]		Full SPN_5	
	$x/\pi(x)$	multiplicity	$x/\pi(x)$	multiplicity
1	2,5	-	1,6667	-
2	4,0	1,60	3,7037	2,22
3	6,0	1,50	5,8824	1,59
4	8,1	1,35	8,1235	1,38
5	10,4	1,28	10,4232	1,28
6	12,7	1,22	12,7389	1,22
7	15,0	1,18	15,0471	1,18
8	17,4	1,16	17,3567	1,15
9	19,7	1,13	19,6666	1,13
10	22,0	1,12	21,9755	1,12

Equation (7) shows that the ratio of cardinal numbers will not come near to the unit and can only reach the values of the 1,0998.

From the article [1] reads: «After more than a careful and complete calculation, Legendre in 1808 found that particularly good approximation is obtained if we subtract from $\ln x$ is not 1, but 1,08366, i.e. $\pi(x) \sim \left| x/(\ln x - 1{,}08366) \right|$». In the formula (7) the constant 1,09980 is little different.

Thus, number of prime numbers, the power has been studied in a number system with base $e = 2{,}718281828$ .... . It is known that this system has the greatest density of information recording and refers to the nonintegral positional systems. But non-integers do not belong to the natural numbers N, let alone to a series of prime numbers $a(n) = \{2, 3, 5, 7, 11, 13, 17, ...\}$.

Thus, the transformation $\ln 10 = 2{,}302585$ ... it was a rough rounded, leading to false identification of physico-mathematical regularities of different series of prime numbers.

With «easy» hands Gauss in mathematics, vigorously developed ***the theory of approximation***, which made it possible to linearize the scale of the abscissa and ordinate in terms of $\ln x$ and $\ln y$. Thus is the fundamental transformation of the statistical data presented at the beginning of the decimal system, in logarithmic. As a result, the ***closed form of design patterns*** that are not only difficult to understand, but they have lost and the visibility of graphics and even more so – the physical representation. Therefore, we continue to recommend in its publications to readers ***an open system of mathematical constructs*** according to the laws of table 1.

Fundamental constants. Formulas from table 1 gives the identification of fundamental physical constants to the parameters a, b, c, d. Processes themselves are unknown.

Carefully consider the formula (4), and compare the values of parameters of the mathematical model with the fundamental constants. Recall that Don Zagier [1] analyzed (see table 2) a very large number of natural numbers $N = \{0,1,2,3,...,10\}^{10}$ with a finite number $a(n) = \{2, 3, 5, 7, 11, 13, 17, ...\}$ of prime numbers and gave them a set of up $\pi(x) \to 455\,052\,512$.

We put forward a hypothesis (table. 4): with an increase in the relative power of the total number of prime numbers, the parameters of the model (4) will tend to the fundamental constant [5].

To a first approximation we replace the law (4) to the physical equivalent to the formula

$$\frac{x}{\pi(x)} = \frac{\sqrt{5}+1}{2\cdot 10}\frac{\mu_p}{\mu_N}\mu_B e^{\left(m_e \sigma_a \frac{g_n}{10}\frac{m_p}{m_n}\right) i_{10}^{\frac{4}{\pi} c_2 \left(\frac{\mu_e}{\mu_B} g_e - 1\right)^8}}, \quad (8)$$

legend of the model parameters (8) are given in table 4 (10 – radix).

The law with the fundamental constants. After substituting the fundamental physical constants in table 4 we write the model (8) as a law of exponential growth

$$x/\pi(x)_f = 4{,}1908462 \cdot 10^{-24} \exp(54{,}435096 i_{10}^{0{,}0190103}). \quad (9)$$

Next check the adequacy of the models (4) and (9). Known formulas allowing to calculate the number of primes faster. In this way, it was calculated that up to 10^{23} is 1 925 320 391 606 803 968 923 primes.

Model (9), obtained from the physical constants in table 4, was even more precise on the relative error, and it gives more accurate predictions of the relative power of the set of prime numbers.

The error for the array $i_{10} = 23$ is equal to only 0,08 %. By the remnants of (9) is obtained (fig. 3) the equations of the perturbation.

Biotechnical law as a supplement to (9) shows that after the discharge $i_{10} = 23$ in the relative power is going on a decline. Damped oscillation shows that with increasing power of primes wave $x/\pi(x)$ tends to zero. When $i_{10} >> 23$ the perturbation is almost excluded.

Table 4

Comparison of parameters of the model (4) of power SPN_5 with the fundamental physical constants

Parameter of the first term of the statistical model (6)			The fundamental physical constant		The multiplicity to a parameter of the model (4)
Type	Name	Value	Name	Value	
the number of time		18 characters*	Number of Napier	$e = 2{,}71828$ ...	≈ 1
Trend (tendency) of prime numbers	Initiation of a series of prime numbers	$1{,}50030 \cdot 1^{-24}$	Bohr magneton	$\mu_B = 9{,}27402 \cdot 1^{-24}$	6,1814
	Active growth of power	55,46724	Electron mass (amu)$\cdot 10^{-4}$	$m_e = 5{,}485799$	$55{,}58486 = m_e\sigma = = 1{,}0021105$
	The growth rate of power	0,019036	Radiation: a second constant	$c_2 = 0{,}0143877$	$0{,}75582 \to \pi/4$
The number of harmony		18 characters*	Golden section $\varphi = 1{,}61803$ ...	$\varphi^{-1} = 0{,}61803$ ...	≈ 1
Parameters of the Earth	Atmosphere	exactly	Standard atmosphere	$\sigma_a = 101325$	1
	Gravitation	The acceleration of gravity (standard)		$g_n = 9{,}80665$	1
Atom	Proton	Magnetic moment/nuclear magneton		$\mu_p/\mu_N = 2{,}7928474$	≈ 1
		Mass of the proton (amu)		$m_p = 1{,}00727647$	≈ 1
	Neutron	Magnetic moment of the neutron		$\mu_n = 0{,}96623707$	≈ 1
		Mass of the neutron (near.)		$m_n = 1{,}0086649$	≈ 1
	Electron	Magnetic moment of/Bohr magneton		$\mu_e/\mu_B = 1{,}00115965$	≈ 1
		Anomaly magnetic moment		$g_n = 2{,}0023193$	≈ 1
Number of space		18 characters*	Number Of Archimedes $\pi/4 = \approx 0{,}78540$	$\pi = 3{,}14159$ ...	≈ 1

N o t e . * – In the mathematical environment CurveExpert the possibility of representing irrational numbers.

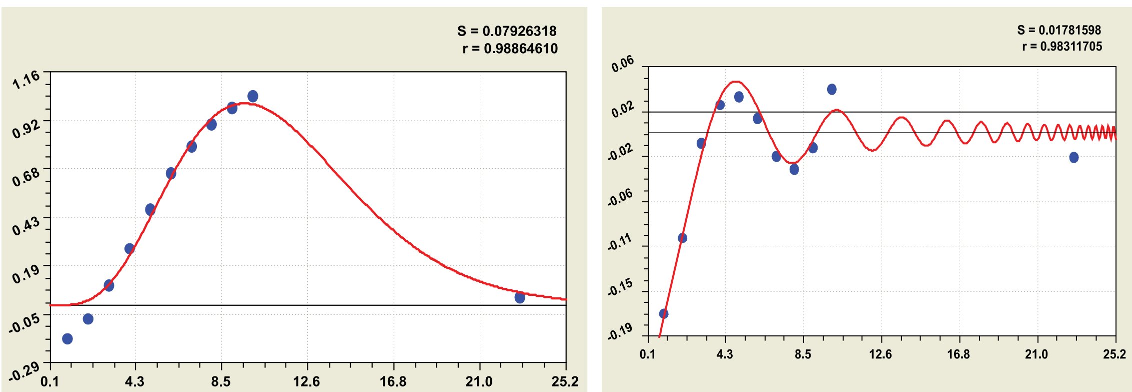

Fig. 3. Diagrams of the perturbation capacity of prime numbers depending on the order of the decimal system

Conclusions

Power total number of primes from the discharge of the decimal system is identified by the law of exponential growth to the fundamental physical constants. With the growth of the power of the prime numbers increases the adequacy of equation (8) with the physical constants, which can lead in the future to the general equation four interactions.

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